19/ENGOS/054 MECHATRONICS ENGINEERING

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MAT 104

(1) $\int e^x \sin x\, dx$

$u = \sin x$, $dv = e^x$

$du = \cos x$, $v = e^x$

$\int uv = e^x \sin x - \int e^x \cos x$

$u = \cos x$, $dv = e^x$, $du = -\sin x$, $v = e^x$

$\int e^x \cos x = e^x \cos x + \int e^x \sin x$

$\int e^x \sin x\, dx = e^x \sin x - e^x \cos x - \int e^x \sin x$

$2\int e^x \sin x\, dx = e^x(\sin x - \cos x)$

$\int e^x \sin x\, dx = \frac{e^x(\sin x - \cos x)}{2}$

(2) $\int 2x^2 \ln x\, dx = \int uv$

$u = \ln x$, $dv = 2x^2$, $du = \frac{1}{x}$, $v = \frac{2}{3}x^3$

$\int uv = \frac{2}{3}x^3 \ln x - \int \frac{2}{3}x^3 \cdot \frac{1}{x}$

$= \frac{2}{3}x^3 \ln x - \int \frac{2x^2}{3} = \frac{2}{3}x^2 \ln x - \frac{2}{9}x^3 + c$

$= \frac{2x^2}{3}\left[\ln x - \frac{x}{3}\right] + C$

(3) $\int x^2 \sin x\, dx = \int uv$

$u = x^2$, $du = 2x$, $dv = \sin x$, $v = -\cos x$

$\int uv = -x^2 \cos x - \int -2x \cos x$

$u = -2x$, $du = -2$, $dv = \cos x$, $v = \sin x$

$-x^2 \cos x - [-2\sin x - \int -2\sin x]$

$-x^2 \cos x + 2\sin x + 2\cos x + C$

(4) $\int x \cos x \, dx$

$u = x$, $du = 1$, $dv = \cos x$, $v = \sin x$

$\int u \, dv = x \sin x - \int \sin x$

$= x \sin x + \cos x + C$